

Water Resources of North Dakota

Variations in Surface-Water Quantity and Quality as a Result of the 1993 Summer Flood in the Devils Lake Basin, North Dakota

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Greater-than-normal precipitation during the summer of 1993 affected the hydrologic response and surface-water quality in the Devils Lake Basin. Large areas in the basin were flooded as a result of the precipitation, and water from these areas drained slowly through the chain of lakes into Devils Lake. This report summarizes the results of surface-water quantity and quality monitoring designed to document the effects of flooding in the Devils Lake Basin. Specific objectives are (1) to document the quantity and quality of streamflow in the Devils Lake Basin immediately before, during, and after the 1993 flood and (2) to document the hydrologic and chemical changes in the upstream chain of lakes and in Devils Lake during April through October 1993. Precipitation during June through August ranged from about 17 inches in the Mauvais Coulee subbasin to about 21.4 inches in the Edmore Coulee subbasin. Streamflow measured for Edmore Coulee

Tributary indicated that 12.2 inches of runoff occurred during April through October 1993. This is one of the greatest runoffs in North Dakota for which records are available. During April through September, the cumulative volume of inflow to the chain of lakes was about 8 percent of the cumulative volume of rainfall and the measured cumulative volume of outflow from the chain of lakes was about 7 percent of the cumulative volume of rainfall. The cumulative volume of water stored in the chain of lakes increased from 6,350 acre-feet in April to 82,300 acre-feet in August and then decreased to 24,400 acre-feet in October. Devils Lake rose from 1,423.0 feet above sea level on June 10 to 1,427.0 feet above sea level on September 28, largely in response to direct precipitation on the lake. Nutrient concentrations for coulees that flow into the chain of lakes generally were at a maximum during the spring and a minimum during the late summer and fall. About 37 percent of the dissolved-solids load and about 43 percent of the total ammonia plus organic nitrogen load was attributed to Edmore Coulee Tributary. Between May and October, increases in the total ammonia plus organic nitrogen mass for the chain of lakes ranged from about 39 to 133 percent. Increases in the total phosphorus mass ranged from about 43 to 157 percent. Decreases in dissolved-solids concentrations from May to early August ranged from about 77 percent in Sixmile Bay to about 9 percent in Main Bay, Creel Bay, and East Devils Lake. Decreases in the dissolved-solids concentrations in Devils Lake and East Devils Lake may have been the result of dilution by direct precipitation. However, during the same period, dissolved-solids concentrations increased about 6 percent in East Bay. Between May and October, the dissolved-solids mass for Devils Lake and East Devils Lake increased 500 million kilograms. Only about 25 percent of the increase can be attributed to streamflow. The total ammonia plus organic nitrogen mass for Devils Lake and

East Devils Lake increased about 38 percent between May and October, and the total phosphorus mass increased about 79 percent.